# There Is No Proof But...
# Addendum to EJVS 7-3 on Vedic Geometry & the History of Science

## Frits Staal

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**Frits Staal**
Universiy of California,
Berkeley

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The final section of Michael Witzel's brilliant and substantial critique of autochthonous theories (*EJVS* 7-3: Section 31) surprises the reader by taking an unexpected turn: it presents an autochthonous theory of Vedic geometry. Its position is more extreme than the "most intense" version of "Out of India" theories (Section 11): for unlike the latter, which has all languages of the world derive from Sanskrit, it denies any relationship between Vedic geometry and other geometries. Paraphrasing Axel Michaels' *Beweisverfahren* of 1978, Witzel writes: "Vedic sacred geometry is autochthonous, and analogies between various cultures are not enough to prove actual historical exchange between them. The burden of proof always is with the one who proposes such an exchange." This statement is followed by a discourse on theoretical versus empirical/sacred/magical that derives via Michaels from the theories of one of the latter's teachers, the philosopher J. Mittelstrass. Autochthonists must be delighted by all of this but will derive scant solace from the history of science.

Sir William Jones in his famous lecture of 1786 provided the fundamental postulate of Indo-European comparative grammar. He did not invoke analogies but "a stronger affinity, both in the roots of verbs and in the forms of grammar, than could possibly have been produced by accident; so strong indeed that no philologer could examine them" (that is, the languages) "without believing them to have sprung from some

common source, which, perhaps, no longer exists." As for proofs, Jones did not provide them, and if much of IE linguistics proves anything, it is that many proofs are still lacking and that we continue to look for them to-day.

Just as Jones did not confine himself to vague analogies, Seidenberg, followed by van der Waerden, did not argue that elementary arithmetic truths that are found all over the world, such as "2 x 2 = 4", must have sprung from a common source. Seidenberg drew attention to very specific constructions that occur in both Greek and Vedic geometry and nowhere else in the ancient world as far as is known. The affinity between these constructions is so strong that it calls for an explanation. Van der Waerden and other historians of science have followed Seidenberg in postulating a common source without accepting his particular 1983 hypothesis, that this source may be Sumerian and older than 1700 BC.[1]

Much has happened in Vedic studies not only since 1786 but since 1978, the year that Michaels' *Beweisverfahren* was published.[2] If we except

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[1] The entire issue is discussed in Staal 1999. Seidenberg refers to RV 1.67.10 which, as Witzel points out, is "much too vague ... to allow proof." But that is entirely consistent with what Seidenberg (1983:122) writes about Ṛgvedic evidence in general, viz., that it "is scanty indeed and could not advance the argument logically."

[2] Michaels' emphasis on *Beweisverfahren* continues a misleading tradition of Euro-American scholarship in the study of Chinese and Indian mathematics. It still pervades influential publications such as Lloyd 1996 but is beginning to be discarded: the search for parallels to Euclid's proofs, i.e., logical deductions from axioms. I accepted that perspective long ago (1963), at least to some extent, when I showed that the Indian counterpart to Euclid's axiomatical and logical deduction is not found in mathematics but in Pāṇini (republished in revised form in 1988:143-60). My lecture expounded the view that Indian philosophy is inspired just as much by grammar as the European is by mathematics, a thesis perhaps first defended by Ingalls (1954) and now widely accepted though not without qualifications. However, I was wrong in assuming that logical deduction

geometry, Witzel makes conscientious use of all relevant recent discoveries and insights, including many unpublished sources that are forthcoming. But Michaels could not and Witzel does not refer to any publications on the history of ancient science that appeared after 1978 and 1983. Even prior to 1978, at least eight volumes (including one on mathematics) had been published of the work that revolutionized the entire discipline: Joseph Needham's *Science and Civilisation in China*.[3]

Needham's work does not only deal with China. It abounds in references to Indian, Arab and European sciences. Needham's greatest contribution is that the history of science during the ancient and medieval periods can only be studied if the Eurasian continent is treated as an undivided unit. Needham's demonstration refutes the idea that Arabs, Chinese, Euro-Americans, Indians and others inhabit separate cognitive worlds that have to be understood in isolation from each other, and is fatal to "Cultural Relativism" (Staal 1998); but it does much more than that. It shows that the majority of sciences developed through complex interactions between the scientific traditions of Eurasia, reaching western Europe relatively late, the Americas still later and finally becoming global. Van der Waerden adopted a similar perspective in *Geometry and Algebra in Ancient Civilizations* of 1983 and it is an

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from axioms, which logicians and philosophers tend to emphasize, is a necessary feature of all mathematics. Van der Waerden, who was (like Seidenberg) a creative mathematician, declared (1961:196) that Euclid was not (like, e.g., Eudoxos or Apollonius) "a great mathematician" but "the greatest schoolmaster known in the history of mathematics." His statement has been vigorously attacked, not so much by mathematicians as by classicists (e.g., Burkert 1972:443, *note* 100, who argues that it is based in part on a mistranslation). As for the common belief, that later Indian mathematics was only indirectly influenced by the Śulba Sūtras (espoused by Michaels: 1978:57), it has been refuted by Hayashi (1995: 60, 64, 81, 105-8 etc., *forthcoming* a, and cf. Staal 2001b on *varga*).

[3] Michaels refers to Neugebauer 1957 but most of his other sources (see especially 1978:96 with notes) are now outdated.

important feature of the history of Indian science (see, e.g., "Foreign Influences" in: Hayashi 1994: 126-7 or Pingree, *forthcoming*, which deals with more directions than the title indicates).

With regard to the later periods, exchanges between Indian, Chinese and Arab mathematics have long been known (see, e.g., Gupta 1980, 1982, 1989). Earlier contacts are likely and worthy of study when they exhibit precise affinities even if historical relationships are not easy to document. That is what Seidenberg and van der Waerden attempted to do, and I, standing on their shoulders and those of Fredrik T. Hiebert and Michael Witzel, tried to continue in 1999[4] and 2001a.

The case of Isaac Newton, the paragon of modern science, demonstrates that scientific knowledge is independent from any "magico-religious" background and that we should look at the results, not what scientists believe or say about it (Staal 1993, 1994, Ch. 1). Newton's Lesson applies to *vyākaraṇa* and *śulba* (2001b) and fits in a wider evolutionary perspective (2001c and *forthcoming*). Takao Hayashi (*forthcoming* b) has illustrated the arbitrariness of beginnings in more precise detail by pointing out that Indian mathematics "first manifested itself in various disciplines such as ritual, prosody, cosmography, calender-making, accounting and commerce; and then developed through interaction with horoscopic astrology and spherical astronomy."

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Madhav Deshpande    University of Michigan, Ann Arbor

Harry Falk    Freie Universitaet Berlin

Yasuke Ikari    Kyoto University

Boris Oguibenine    University of Strasbourg

Asko Parpola    University of Helsinki

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